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Increasing the Effectiveness of Ocean Observations for Enhancing Coastal Community Resiliency and Reducing Risk

SEACORM-NOAA Workshop
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Russell Jackson and David McKinnie
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US IOTWS Program

- Designed to provide strategic support for development of an operational “end-to-end” tsunami/multi hazard warning and mitigation system for the Indian Ocean region.
- Program areas support observations (DART), analysis, forecast and warning/warning cancellation, communication, preparedness, and coastal community resilience.
- Implemented through the IOC’s Intergovernmental Coordination Group for the IOTWS where possible.

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Multi-hazards End-to-End Systems

- Tsunami events are most demanding coastal hazards
  - Very little (or no) potential warning time
  - Systems must perform flawlessly
  - Local populations must react immediately
- Tsunami events are relatively rare, but can have extremely high consequences
- Detection, forecast, warning, and communications systems that address multi hazards more effective and sustainable
- Coastal Community Resilience is a critical element of any tsunami or multi hazard end-to-end system

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Coastal Community Resilience

- Coastal Community Resilience is the integration of coastal management, hazard mitigation, and disaster management planning
- Resilient communities plan and prepare for coastal hazards because they are inevitable and expected; planning allows a community to manage outcomes and rebuild with less loss and disruption
- Communities face different coastal hazards
- Ocean observations can play a critical role in helping communities become more resilient

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Coastal Community Resilience

Ocean Observations and Resilience

- Common view that ocean observations are used only for the forecast phase of severe events (typhoons, floods, tsunami, etc.)
- But there are three groups of applications of ocean observations for communities:
  - Forecast and warning/warning cancellation
  - Post-event analysis
  - Mitigation and disaster planning

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Observations about Ocean Observations

- Observations can be an important and effective tool
- Observation must be placed in an appropriate modeling, analysis, and communications infrastructure
- Observations can be used in different time scales and different resolutions for different purposes and needs
- Observations do not replace cultural/traditional knowledge, simple direct measurements, or common sense approaches
- Observations are most valuable when a community is prepared and resilient

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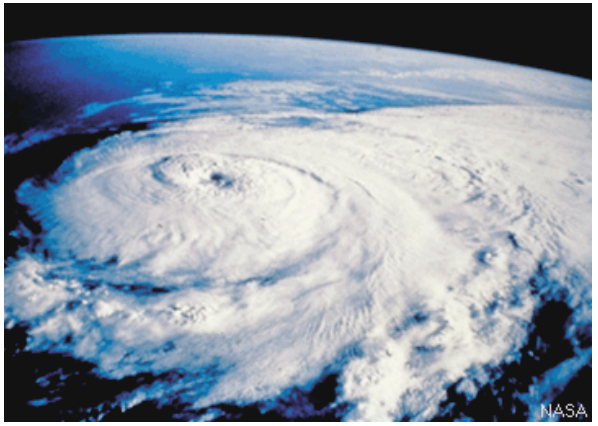
Ocean Observations in Forecasts and Warning

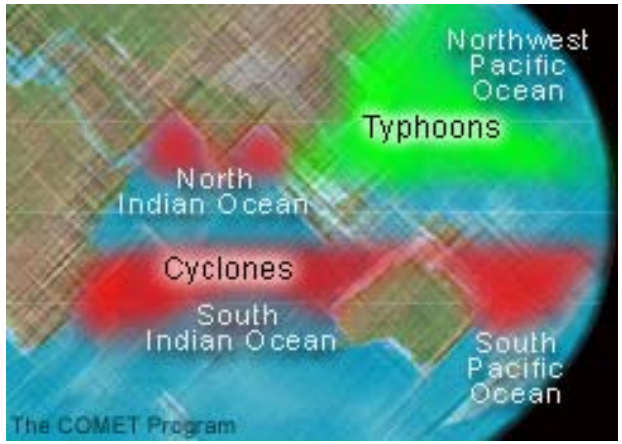
- Use of buoys, water level gauges, C-man stations, satellites, other as inputs into forecast models
- Use of analysis to generate warnings
- Use of ocean obs data to verify model outputs and forecasts to improve performance

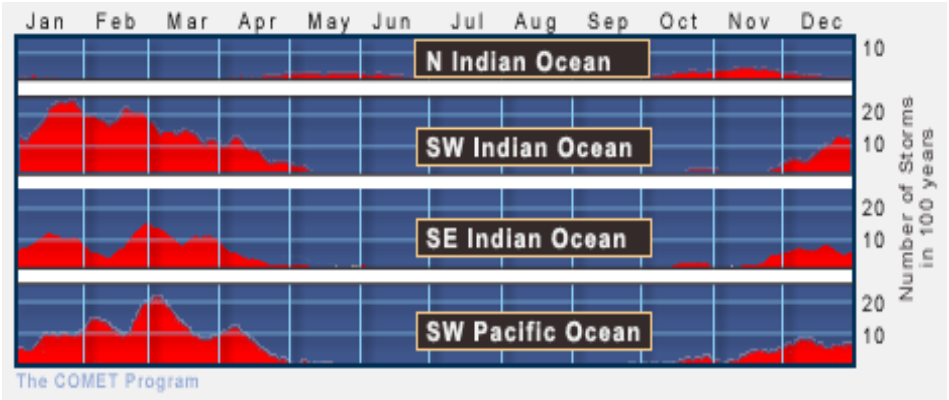


Ocean Observations for Hazard Assessment

Ocean observations:

- Time series, long term observation help assess risk from specific coastal hazards
- Help identify patterns and cycles (tropical storms, seasonal rainfall
- Help determine intensity of threat





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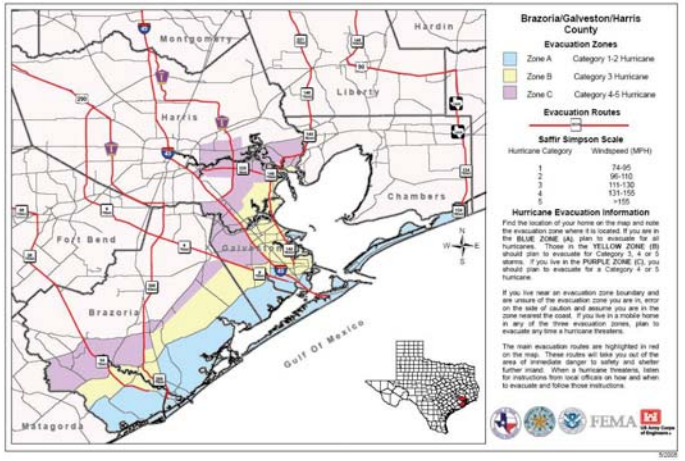
Ocean Observations for Resiliency

- Long term and event data create likely scenarios for which a community should plan
- Data can be used to identify vulnerable areas
- Observations can assist with evacuation planning and other preparedness
- Data can provide foundation for long term mitigation (land use planning, resource protection



US Example for Hurricane Storm Surge

- During tropical storms, low atmospheric pressure creates a “dome” of water; this dome can cause great flood damage as the storm comes ashore.
- It is critical to understand the worst-case storm surge scenario for evacuation planning and for hazard mitigation
- Storm surge models are used to generate scenarios for inundation
- For tsunamis, different models are used to identify potential inundation areas

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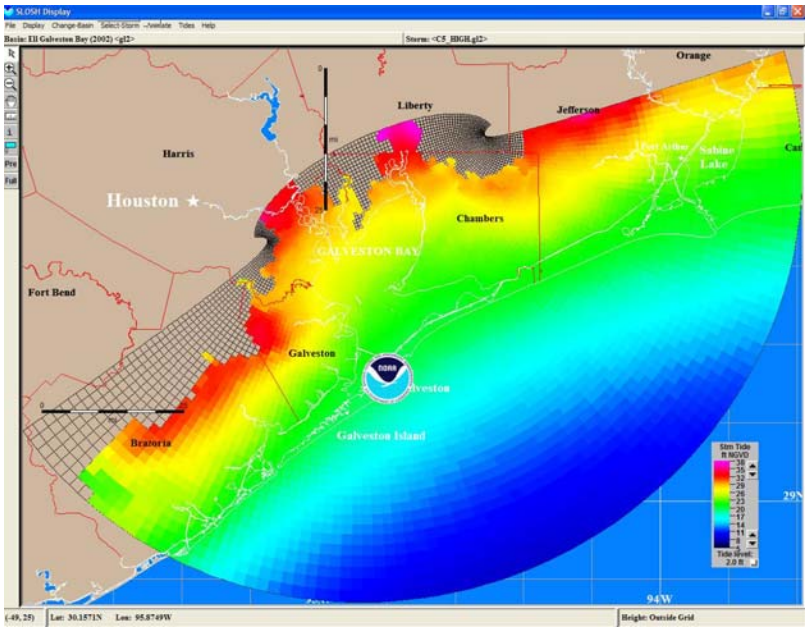
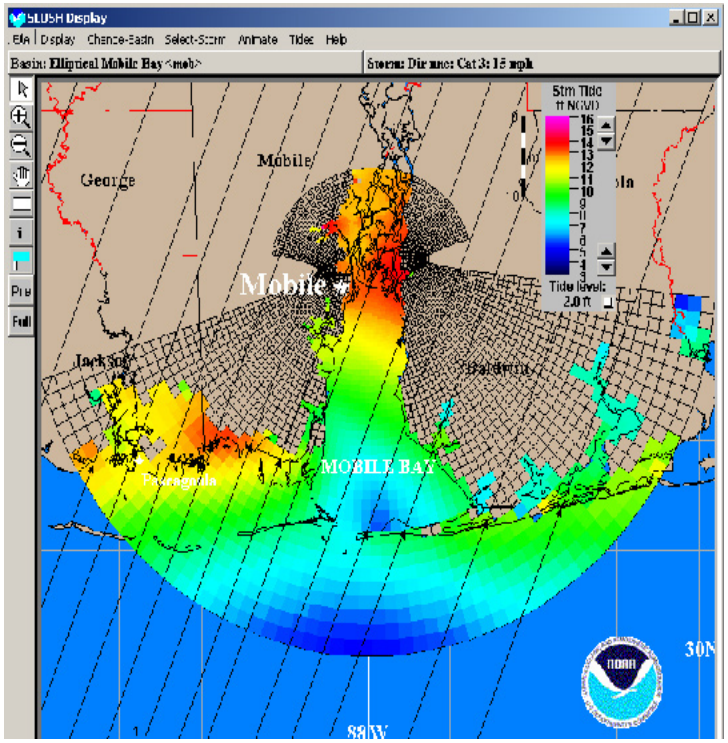
US Example for Hurricane Storm Surge

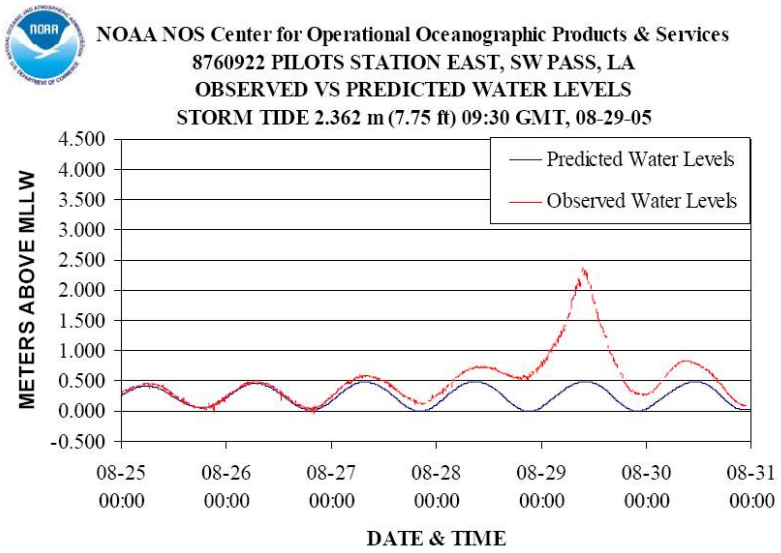
Models for Galveston and Mobile





US Example for Hurricane Storm Surge

- Models require observational data from past events
- Bathymetry and topography needed
- Thousands of runs needed to generate data base of potential storm magnitudes and directions



US Example for Hurricane Storm Surge

- Scenario results then used to define evacuation zones (for level 1-5 storm intensity categories)
- Based only on potential storm surge, not wind or wind waves
- Model outputs are then used by mitigation planners, disaster managers, and others to plan and implement evacuation, sheltering, and other emergency services.

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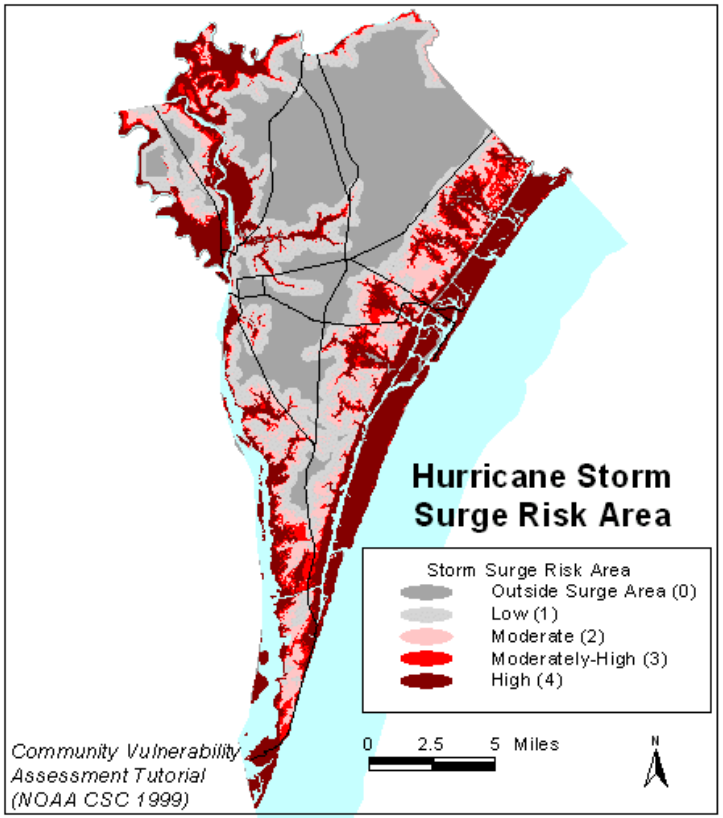
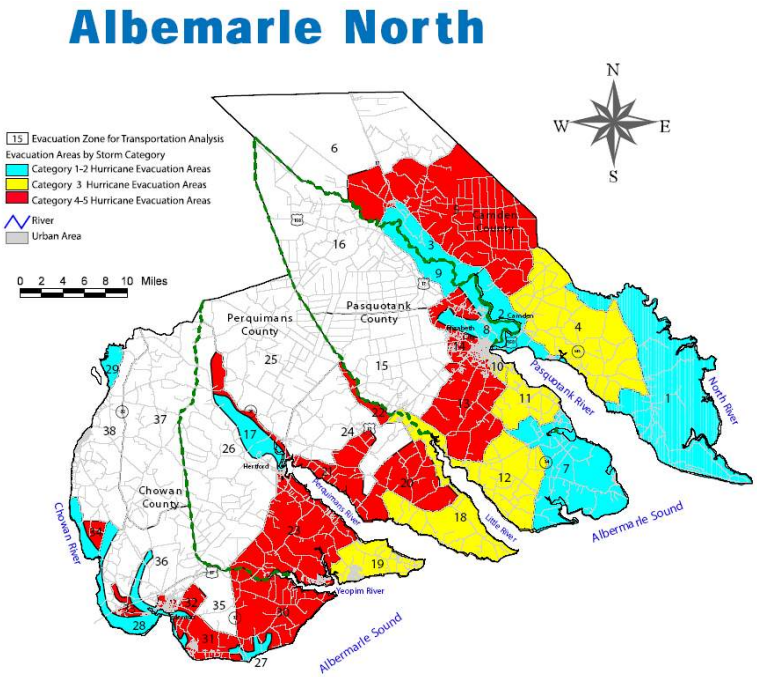
US Example for Hurricane Storm Surge





US Example for Hurricane Storm Surge

- Importantly, these models and observations are used to mitigation future disasters
  - Land use zoning
  - Building codes
  - Discouraging development in high risk areas
  - Protect sand dunes, vegetation, and other protective features

Relevance for Indonesian Coastal Hazards Issues

- Indonesia's threat from tropical storms is relatively low compared to other nations (India, Bangladesh, U.S., etc.)
- But there are many parallels between the steps required to prepare for and mitigate impacts from tropical storms and for tsunamis (a multi-hazards approach)
- An understanding of longer term cycles of variability and of change can help Indonesia prepare for coastal hazards and minimize impacts

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Relevance for Indonesian Coastal Hazards Issues

- Examples include:
  - Protection of corals, beaches, vegetation
  - Inundation zone identification
  - Evacuation planning
  - Planning for emergency shelter and other services in the event of disaster or disruption
  - Recovery planning

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Questions?

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